MULTIMEDIA UNIVERSITY

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FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BMT1814 – MANAGERIAL MATHEMATICS
(All Sections / Groups)

12 OCTOBER 2016
2.30 p.m. - 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages, inclusive of a list of formulae.

2. Attempt all 4 questions. The distribution of marks for each question is given.

3. Students are allowed to use scientific calculators.

4. Please write your answers in the **Answer Booklet** provided.

Question 1[Total =25 marks]

a) Find a linear equation which parallel to a line $5y + 3x = 15$ and passes through point (3,-2).   [6 marks]

b) On January 2011, Company A purchased a vehicle costing $120,000. The company expects the vehicle to be operational for 4 years at the end of which it can be sold for $50,000, where t is the age of the vehicle in years.
   (i)   What is the rate of depreciation of the vehicle's value yearly?   [3 marks]
   (ii)   Find a linear equation that describes the value of the vehicle. Write the final answer in the form $V(t) = mt + b$.   [4 marks]

c) Solve the following linear programming problem using the corner point method.

$$Max \quad Z = 3x + 5y$$
$$\text{subject to} \qquad 4x + 4y \leq 48$$
$$x + 2y \leq 20$$
$$x, y \geq 0$$

[12 marks]

Question 2[Total =25 marks]

a) Five and a half years ago, Rina invested $10,000 in a retirement fund that grew at the rate of 10.82% compounded quarterly. What is her account worth today?

[6 marks]

b) How many years (to the nearest integer) will it take $12,000 to grow to $15,000 if the investment earns interest at the rate of 8% compounded monthly?

[6 marks]

c) The Martin couple is planning to go to Europe 3 years from now and have agreed to set aside $150 per month for their trip. If they deposit this money at the end of each month into a saving account paying interest at the rate of 8% compounded monthly, how much money will be in their travel fund at the end of the third year?

[6 marks]

d) Teresa and Raul purchased a house for $200,000. They made a down payment of 20% of the purchase price and secured a 30-year home mortgage at 6% per year compounded monthly on the unpaid balance. How much was their month mortgage payment for the house?

[7 marks]

Continued....

Question 3 [Total =25 marks]

a) Find the derivatives of the following functions:

   (i) $f(x) = 4x^5 + 3x^4 - 8x^2 + x + 3$ [3 marks]

   (ii) $y = \dfrac{3}{x^3} + \dfrac{4}{\sqrt{x}} + 1$ [3 marks]

   (iii) $f(x) = x^3\left(\sqrt{x} + 1\right)$ [4 marks]

b) Ditton Company manufactures an electrostatic speaker system. The quantity x of these speaker system demanded each week is related to the whole-sale unit price (in dollars) by the equation

$$p = -0.006x + 180 \qquad\qquad \left(0 \le x \le 30,000\right)$$

   The weekly total cost (in dollars) incurred by Ditton Company for producing x units is

$$C(x) = 0.000002x^3 - 0.02x^2 + 120x + 60,000$$

   (i) Find the revenue function, R(x) and the profit function, P(x).   [4 marks]

   (ii) Find the marginal revenue function, R'(x) and marginal cost function, C'(x).

                                                                [2 marks]

   (iii) Find the marginal cost when the x=7000. Interpret the result.   [3 marks]

c) For the following function: $f(x, y) = x^2 + xy + y^2 + 2x - y$

   (i)   Find the first partial derivatives, f_x and f_y.   [4 marks]

   (ii)   Compute $f_x(-1,2)$ and $f_y(1,-2)$ [2 marks]

Question 4 [Total = 25 marks]

a) Integrate the following functions:

   (i) $\displaystyle\int t^{3/2} + 2t^{1/2} - 4t^{-1/2}\,dt$ [4 marks]

   (ii) $\displaystyle\int_{1}^{2} 1 + \dfrac{1}{x} + e^x\,dx$ [6 marks]

b) Solve the following indefinite integral using integration by substitution:

$$\int 3t^2 \sqrt{t^3 + 2}\,dt$$

                                                                         [7 marks]

c) Find the area bounded by the graph $f(x) = x + 3x^2$, the x-axis and the line x=4 to x=8.   [8 marks]

End of paper

LIST OF FORMULAE

Linear & Quadratic Equation

1.	**Quadratic Equation**

Solution of quadratic equation : $ax^2 + bx + c = 0$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Mathematics For Finance

1. Simple Interest

Interest, $I = Prt$

Accumulated amount, $A = P(1 + rt)$ or $A = P + I$

2. Compound Interest

$A = P(1 + i)^n$ where $i = \dfrac{r}{m}$ and $n = mt$

3. Effective Rate of Interest

$$r_{eff} = \left(1 + \frac{r}{m}\right)^m - 1$$

4. Present Value for Compound Interest

$P = A(1 + i)^{-n}$

5. Annuity

$$S = R\left[\frac{(1 + i)^n - 1}{i}\right] \qquad\qquad P = R\left[\frac{1 - (1 + i)^{-n}}{i}\right]$$

6. Amortization

$$R = \left[\frac{Pi}{1 - (1 + i)^{-n}}\right]$$

7. Sinking Fund

$$R = \left[\frac{iS}{(1 + i)^n - 1}\right]$$

Derivative
Basic Rules of Differentiation

a) Derivative of a constant: $\dfrac{d}{dx}(c) = 0$

b) Power rule: $\dfrac{d}{dx}(x^n) = nx^{n-1}$

c) Sum rule: $\dfrac{d}{dx}[f(x) \pm g(x)] = \dfrac{d}{dx}[f(x)] \pm \dfrac{d}{dx}[g(x)]$

a) Product rule: $\dfrac{d}{dx}[f(x) \bullet g(x)] = \dfrac{d}{dx}[f(x)]g(x) + \dfrac{d}{dx}[g(x)]f(x)$

b) Quotient rule: $\dfrac{d}{dx}\left[\dfrac{f(x)}{g(x)}\right] = \dfrac{g(x) \bullet \dfrac{d}{dx}[f(x)] - f(x) \bullet \dfrac{d}{dx}[g(x)]}{[g(x)]^2}$

c) Chain rule: $\dfrac{dy}{dx} = \dfrac{dy}{du} \bullet \dfrac{du}{dx}$

d) General Power rule: $\dfrac{d}{dx}[u^n] = nu^{n-1}\dfrac{d}{dx}u$

e) Logarithmic function: $\dfrac{d}{dx}(\ln u) = \dfrac{1}{u}\left(\dfrac{du}{dx}\right)$

f) Exponential function: $\dfrac{d}{dx}(e^u) = e^u\dfrac{du}{dx}$

Integration
Basic Rules of Integration

a) Indefinite integral of a constant: $\int k \, du = ku + C$

b) Power rule: $\int u^n \, du = \dfrac{u^{n+1}}{n+1} + C$

c) Sum rule: $\int [f(u) \pm g(u)] \, du = \int f(u) \, du \pm \int g(u) \, du$

d) Logarithmicfunction: $\int \dfrac{1}{u} \, du = \ln u + C$

e) Exponentialfunction: $\int e^u \, du = e^u + C$

Calculus of Several Variables

1. **Determining Relative Extrema**

$$D(x,y) = f_{xx}f_{yy} - f_{xy}^{2}$$

D(a,b)	$f_{xx}(a,b)$	Interpretation
+	+	Relative min. at (a,b)
+	−	Relative Max. at (a,b)
−		Neither max. or min. at (a,b)
0		Test is inconclusive

Others

1. **Average Cost Function**

$$\overline{C} = \frac{C(x)}{x}$$

2. **Marginal Average Cost Function**

$$\overline{C}'(x)$$